I. Blood Cell Connections Q?

II. Lab 5 Review: Safety & Techniques Q?

III. Blood Glucose & Insulin LS pp 530-2, DC pp 110-2

IV. Introduction to Endocrinology LS ch 17, DC Module 13, SI Fox+
   A. Endocrine vignette: Cushing's syndrome LS fig17-20 p 521-2
   B. Endocrine system DC p 103 fig 13-1, LS fig 17-1, tab 17-1
   C. What’s an endocrine? + classes ~ LS pp 495 – 6
   D. Hypothalamus (Master) – Pituitary (subcontroller)
      DC pp 104-6 + LS pp 499-506
   E. Posterior pituitary + hormones DC p 108, LS fig 17-4 p 502
   F. Anterior pituitary + hormones DC pp 105-7, LS pp 502-6
   H. Peripheral endocrine organs DC pp 109-13, LS pp 513-36
      1. Pancreas 2. Thyroid 3. Adrenals

Fun lab today! Lifetime data! Thanks for being prepared!
No food, drink or gum in lab today! Thanks sincerely!

...Healthy, tasty & fresh, but not in lab!!
PREPARATION

1. WASH & DRY

2. ALCOHOL
SAMPLE + TESTS

1. OBTAIN \( \mu \)SAMPLE

2. BLOOD GLUCOSE

3. BLOOD TYPING
Glucose: Sugar in Blood

Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: ≥ 126 mg/dL

NB: Read & Record!
BLOOD TYPING

ADD ANTISERA

MIX W/TOOTHPICKS

READ & RECORD!!
1° Q? Clumping in Any Wells?

Source: S Wong, BI 121 Lab, 2016
CLEAN-UP!

1. FOLD DIAPER

2. BLOOD PRODUCTS

3. REWASH!!
Diabetic & Normal Response to Glucose Load

Ingest Glucola or eat meal

Guyton & Hall 2000
Fig. 10-4. Amino acid sequence of a mammalian proinsulin molecule. Note how the insulin molecule can be formed by cleaving this polypeptide chain at two locations to liberate the C peptide.
Endocrine Pancreas: Insulin (I) & Glucagon (G)
See-Saw Hormones in Regulating Blood Glucose

- Duct cells secrete aqueous NaHCO₃ solution
- Acinar cells secrete digestive enzymes

Exocrine portion of pancreas (Acinar and duct cells)

Duodenum

Hormones (insulin, glucagon)

Endocrine portion of pancreas (Islets of Langerhans)

Bile duct from liver

Stomach

Blood

The glandular portions of the pancreas are grossly exaggerated.
Times of Plenty!!

NB: Diabetics have problems either here or here.

https://www.youtube.com/watch?v=8dgoeYPoE-0
### TABLE 4-7

**Warning Signs of Diabetes**

These signs appear reliably in type 1 diabetes and, often, in the later stages of type 2 diabetes.

- Excessive urination and thirst
- Glucose in the urine
- Weight loss with nausea, easy tiring, weakness, or irritability
- Cravings for food, especially for sweets
- Frequent infections of the skin, gums, vagina, or urinary tract
- Vision disturbances; blurred vision
- Pain in the legs, feet, or fingers
- Slow healing of cuts and bruises
- Itching
- Drowsiness
- Abnormally high glucose in the blood

S&W 2011 tab 4-7 p 131
Diabetics must constantly juggle diet, exercise & medication to control blood glucose!
Like others, diabetics benefit from whole grains, vegetables, fruits, legumes & non-/low-fat milk products!
Discussion/Questions/Break!
Cushing’s Syndrome = Hypersecretion of Cortisol: Hypothalamic (CRH), Pituitary (ACTH), or Adrenal (Cortisol)

T = 0, near normal

T = 4 months later
ANP = Atrial Natriuretic Polypeptide

https://www.youtube.com/watch?v=lRJE8c3ghRE
https://www.hopkinsallchildrens.org/Patients-Families/Health-Library/HealthDocNew/Movie-Endocrine-System
Hormone/Endocrine Classifications

Exogenous

Endogenous
Hypothalamus & Pituitary: Intimate Relationship
Hypothalamus
< 1% of Brain Mass
Hormone Master Controller
+100s of Functions!

Good Things Come in Small Packages!

Kreiger & Hughes 1980
Pituitary Nourishing or Growth Hormones

RH + or RIH -

Hypothalamus

Systemic arterial inflow

Neurosecretory neuron

Hypothalamic-hypophyseal portal system

Releasing or Release-Inhibiting Hormones

Systemic venous outflow

= Hypophysiotropic hormones  = Anterior pituitary hormone

Hypophysis = Pituitary

LS 2007
Capillary-Venule-Capillary Intimate Circulation

Krieger & Hughes 1980
Paraventricular nucleus
Supraoptic nucleus
Median eminence
Portal system
Infundibulum
Hypothalamus
Anterior pituitary
Posterior pituitary

TSH
Prolactin

 ACTH

Gonadotropins
FSH
LH

Thyroid
Adrenal cortex

Bone
Muscle
Adipose tissue

Ovary
Testis
fig 17-10
Progression & Development of Acromegaly

Age 13

Age 21

Age 35
Growth Hormone = Somatotrophic Hormone
Body Builder’s Dream?
GH/STH Effects: Insulin Resistance/Type II Diabetes?

↑ Amino Acid uptake & Protein synthesis

↑ Lipolysis & Fatty Acid mobilization

↓ Glucose uptake
  (skeletal muscle & adipocytes)

↑ Glucose production
  (liver glycogenolysis)

↑ Insulin secretion
Increase GH naturally with exercise & sleep!!

Graph showing growth hormone levels over time, with peaks during sleep and exercise. Ng/ml = nanograms per milliliter.
Insulin Stores Sugar, Glucagon Mobilizes Sugar!

High blood sugar

Promotes insulin release

~ 4-6 hr of Stored Glucose

Peripheral Endocrine & Digestive Organ

Stimulates glycogen breakdown

Glucagon

Promotes glucagon release

Stimulates glucose uptake from blood

Insulin

Promotes insulin release

Liver

Glycogen

Glucose

Lowers blood sugar

Tissue cells

Low blood sugar

Raising blood sugar

Benjamin Cummings 2001

https://www.youtube.com/watch?v=y9Bdi4dnSlg

https://www.fuseschool.org
Thyroid → metabolism highly vascularized

Adrenals / Suprarenals

Adrenal gland

Cortisol

Adrenal cortex

Adrenal medulla

Adrenalin Hormones

Kidney

Stress hormones!

FIGURE 13-12
Adrenal Gland
The adrenal glands sit atop the kidney and consist of an outer zone of cells, the adrenal cortex, which produces a variety of steroid hormones, and an inner zone, the adrenal medulla. The adrenal medulla produces adrenalin and noradrenalin.
Epinephrine 80%
Norepinephrine 20%

Figure 77-1
Secretion of adrenocortical hormones by the different zones of the adrenal cortex.
Adrenals/Suprarenals

- Adrenal medulla
- Adrenal cortex
- Mineralocorticoids (aldosterone)
- Glucocorticoids (cortisol) and sex hormones (dehydroepiandrosterone)
- Catecholamines (epinephrine and norepinephrine)
Stress Promotes Cortisol Secretion

Metabolic fuels and building blocks available to help resist stress

- Blood glucose (by stimulating gluconeogenesis and inhibiting glucose uptake)
- Blood amino acids (by stimulating protein degradation)
- Blood fatty acids (by stimulating lipolysis)